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ABSTRACT

Planning issues and computing technology changes are reviewed and decision support systems are examined as a means of providing an appropriate information system for the university institutional research office. Examples of formative attempts to provide such systems at Carnegie-Mellon University (CMU) and other institutions are considered. The possible implications of the increased use of such systems are explored, since much of the challenge to college planners and administrators results from the instability of the environment. Computing technology offers an opportunity for creating flexible planning support systems that are responsive to decision makers, and can take advantage of computing technology. The environmental forces having the greatest impact on colleges have been inflation, erratic economic growth, and student demographics. CMU's planning environment has emphasized strategic planning and planning support information. The CMU database was structured at the departmental level with aggregation to the college and university level. The data were structured along three dimensions: department, variable (e.g., undergraduate full-time-equivalent enrollment), and time (e.g., fiscal year). The basic model allots 10 columns for each department, 5 for historical data and 5 for forecasting. A compact model uses five columns of historical data only for reporting and data retrieval, and a fiscal year model includes one year of data for each department. The database, which uses the EMPIRE computer language, is useful for statistical analysis. One common analysis is creating ratios and reviewing patterns among departments. The role of institutional research staff, training of staff and career paths, and institutional resources are addressed. (SW)

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A DISTRIBUTED INFORMATION STRATEGY

by

Michael E. Baker

U.S. DEPARTMENT OF EDUCATION
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14 May 1982

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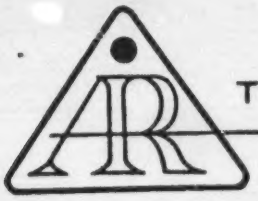

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D. R. Coleman, Chairman
Forum Publication
Advisory Committee

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A DISTRIBUTED INFORMATION STRATEGY

Introduction

College and university planners and administrators have faced a particularly challenging environment in recent years. A large part of the challenge comes not just from the issues, but the instability of the environment. Planning methods and support systems have to be flexible and adaptive to be effective in such an environment. Arns has stated the case nicely:

> "Given these conditions, most institutions need a quantum leap in emphasis on process and in the quantity and quality of information available for decision making."[1]

Computing technology offers an opportunity for creating flexible planning support systems.

How should an institutional research office decide what kind of informational strategy should be used? The concept of decision support systems is an attractive approach. Such systems are flexible, responsive to decision makers, and can take advantage of computing technology.

What are some of the likely impacts on institutional research of the wide use of decision support systems in higher education? Computer literacy may become a "core" requirement for institutional research. Institutional researchers may become more involved in developing systems and facilities and less involved in doing research and analysis. There will be a greater need for decision makers and institutional researchers to develop meta analysis or heuristics to handle the increasing complexity of computer-based information systems.

This paper reviews planning issues, computing technology changes, and examines decision support systems as a means of providing an appropriate information strategy. Examples of formative attempts to provide such systems will be given from Carnegie-Mellon University and other institutions. The possible implications of the increased use of such systems are explored.

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[1] Arns

College Planning Environment

Planning Issues and Environment

The 1970's were a period of dramatic change for higher education and these changes show no sign of abating in the 1980's. As if these changes themselves were not enough planning challenge, the changes occur sporadically. This creates a great deal of uncertainty. These change forces can be grouped in three areas: environmental, structural, and expectational. Each of these forces will be reviewed briefly.

The environmental forces having the greatest impact on universities have been inflation, erratic economic growth, and student demographics. Inflation has been cited exhaustively as a major societal problem. It has certainly had a large impact on higher education. Endowment growth has been sluggish. Faculty salaries have lagged inflation rates. Research funding has grown impressively in current dollars, but real growth has been very modest. Fund raising has been hurt by inflation. And while disposable income has generally grown faster than inflation, high tuition rates are causing concern among families with college-bound children. But the greatest planning challenge has been the erratic acceleration and deceleration of inflation. This is a special challenge for higher education planners and administrators, as tuition and faculty salary decisions are made months in advance.

The United States economy has experienced starts and stops during recent years. Even the modest real growth rate has been sporadic. Real GNP actually declined in 1974 and 1975. It is understandable that the 1970's were difficult years for colleges and universities, given this economic climate. Prospects for the 1980's appear to be similar.

Demographics, of course, are an important topic to college planners. The National Center for Education Statistics had projected a 16 percent drop in the number of high school graduates between 1978-79 and 1988-89.[2] This decrease varies substantially across the country. For example, the Pennsylvania Department of Education projected a 24 percent drop in high school graduates between 1979 and 1989.[3] There are several factors which could lessen the effect of this decrease. High school graduates may choose to attend college at a greater rate as they did for Fall, 1981. Many colleges have turned to non-traditional students as an alternate market for their services. Still, the dramatic shift in the number of high school graduates is an event to be carefully watched in higher

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[2] Frankel and Gerald, Table 15

[3] Lat anzio et al

education, especially in certain states.

The 1970's were also a period of structural changes in education. A look at United States enrollment trends between 1968 and 1978 shows some of the significant changes.[4] The market share of public institutions increased from 72% of total enrollments in 1968 to 78% in 1978. 2-year, public institutions accounted for this increase as their market share went from 22% to 34%. During this same period, public, 4-year enrollments dropped from 50% of the total to 44% while private, 4-year enrollments decreased from 26% to 21%. Clearly an increasingly diverse group of students were choosing a diverse group of institutions for their education.

Expectations for higher education have also changed. Hester has described three phases of the role of higher education in the United States.[5] After an initial elitist phase, emphasis shifted to a meritocratic concept, and then to an emphasis on egalitarian access. Hester states that:

> "none of the three phases has ever eclipsed entirely the previous ones, but that all three are to be seen today and continue to exert influence."[6]

It is certainly likely that concern about the effective use of resources may shift some policies from an egalitarian basis to a meritocratic one, at least temporarily. Bok has recently proposed such a concept for awarding federal student financial aid funds.[7] The existence of these competing philosophies of education means that there will be tension among these goals at all policy levels: institutional, state, and federal. This tension leads to increased instability of the policy climate. Unfortunately, difficult economic times tend to exacerbate these tensions.

Each of the three areas cited above (environmental, structural, and expectational) are likely to provide continued planning challenges for colleges and universities in the 1980's. Not only are the long-term trends of little comfort to higher education, but the suddenness of changes and counter-changes themselves present the most significant planning challenge. Several social scientists have predicted an increase in "political behavior" in reaction to such conditions. Arns has stated that management and planning must become more technically sophisticated and sensitive in such situations.[8] What about planning tools to meet these

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[4] Frankel Tables 2, 7A, & 7B

[5] Hester

[6] Hester

[7] Hook

[8] Arns

challenges?

Planning Methodologies

The kind of forces described above require an adaptive and flexible planning system. Institutional requirements demand the same responsiveness.

Recent experience at Carnegie-Mellon University finds about half the policy issues being recurring (e.g. enrollment, financial aid, faculty salaries, space) but the other half are continually changing. Leadership changes among senior executives are another reason for changing planning agendas. Even in a stable situation, a planning office must be prepared to answer different questions from different administrators. Departments heads ask different questions than deans do, who ask different questions than provosts do. This normal organizational context, itself, requires a flexible planning system.

Certainly college planning methods reflect this diversity of needs. For example, Heydinger cites thirteen academic planning styles in his taxonomy.[9] Planning styles may vary because of differences in the philosophy, mission, or leadership style of an institution.[10] St. John has proposed differences in institutional planning needs based on the structural development of colleges.[11] St. John used enrollment and administrative complexity as indicators of college and university structural development.[12] These analyses suggest that many differences in planning methods are appropriate, given institutional differences. And more importantly, a single institution may need to use different methods in different planning contexts.

There is a great diversity of planning methods used by universities. Both this diversity and the dynamic environment for colleges point to the need for flexible planning information system. Computer-based planning systems provide a potential means for insuring this flexibility.

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[9] Heydinger1

[10] Heydinger2

[11] St. John1

[12] St. John2

Computing Environment

The price/performance trends in computing hardware are well known. The cost of computing power and memory is declining at about 20 percent per year. An additional trend is also important. Small computer costs are declining as fast, or faster, than large computer costs. For the first time there is no longer economy of scale for computing hardware. These trends have lead to an increase in distributed computing (via mini and micro computers) which has only just begun!

The opposite trend has occurred for software. Because of the relative scarcity of qualified programmers, software costs increase substantially each year. However, this trend has resulted in important software developments. As the cost of specialized programming in a language like COBOL or FORTRAN has become more expensive, there is an incentive for the development of software packages that can do a variety of tasks, common to a large group of users. Fortunately, the interest in forecasting and analysis has lead to the creation of many excellent modeling and statistical analysis packages. These packages have gained acceptance among institutional researchers. More importantly, packages have been improved to offer broader capabilities. For example, SPSS, an analysis package, has had a report writing feature added. This trend means that users can now find more features in a single package, increasing the sophistication or comprehensiveness of possible information system.

These software development trends mean that universities can have access to sophisticated packages at relatively modest prices. The hardware trends mean that computing can be offered to more people on campus. The combination of these trends is a dramatic opportunity for computing to support a variety of planning activities. Not only are previous tasks enhanced, but new tasks are possible; tasks that were impossible a few years ago.

An example should be cited. When Stanford University began its long-range, equilibrium financial planning, a custom program was developed.[13] Because of the value of these programs and the availability of a country-wide university computer network, EDUCOM, with foundation support, was able to refine these programs to create EFPM, a sophisticated modeling package. EFPM has been used by over 100 colleges and universities. Now, microcomputers and associated software offer planners packages like VISICALC. While some institutions might pick one of these packages for their modeling, most would benefit from having both (or similar tools). The April, 1982 *EFPM Newsletter* summarized EDUCOM's position:

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[13] Hopkins

> "We expect that the optimum strategy for most institutions will involve something like VISICALC and something like EFPM..."

So not only are valuable systems available, at reasonable prices, but the user frequently has a choice from a range of packages.

Two other examples illustrate how computer systems can support planning. Both of these examples are spin-offs of EFPM efforts, made possible by the *EFPM Newsletter* and active users group. Hughes and Dickmeyer developed at workbook for college financial self-assessment. An EFPM model was created to permit users to do their assessment via EFPM. In addition to the computational advantages of EFPM, users could specify peer institutions using EFPM to form a data file with a set of comparative statistics. Based on this experience and requests from subscribers, other plans are being made to develop a peer data sharing and analysis feature as part of the EFPM facilities. These examples show how broader, related capabilities can be added to computer planning systems.

Strategic Analysis

Given a dynamic planning environment and increasingly available computer technology, how should an institutional research office develop an information strategy for an institution? Strategic planning offers several methods for analyzing this situation. One of the frequently used tools in strategic planning is called a WOTS analysis.[14] WOTS stands for weaknesses, opportunities, threats, and strengths. Performing a WOTS analysis for an institutional research office's information strategy can give direction to planning efforts.

Traditionally, institutional research has produced products like fact books and special studies. This information, while useful, is not readily accessible by planners or administrators in a dynamic planning environment. This lack of appropriate accessibility is a weakness of the traditional approach, given the current planning situation.

Institutional research does have several strengths. These strengths relate to the collection, analysis, and interpretation of information. These abilities are important irrespective of the information technology used. A planning information system would need to use these skills.

Computing technology clearly offers a tremendous opportunity for making information systems computer-based. Some of the potential advantages of a computer-based system are access, flexibility, and responsiveness. An example shows several

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[14] Steiner and Miner

important factors. Financial planning has become more efficient using computer systems. More options can be considered in the same amount of time. But additionally, a model like EFPM can do a feasibility search to explore the tradeoff between two variables. For example, a planner could search to find a set of tuition increases and faculty salary increases that would maintain a balanced budget. This search would be virtually impossible without computer support.

The threat for institutional research is that other groups in the organization could provide leadership for computer-based information systems. Directors of administrative data processing or budgets could lead system development efforts. This is a particularly imposing threat for institutional researchers who do not have a computing background.

A promising information strategy that responds to this strategic analysis is the concept of Decision Support Systems. The next section of this paper will outline this concept.

Decision Support Systems

Operations Research and Management Information Systems are methods that have already been used to provide technical solutions to management decisions. A newer method is called Decision Support Systems (DSS). DSS is unique in its primary orientation to needs of the decision maker. This concept parallels the planning information needs described in previous sections.

Keen has written about Decision Support Systems and their application.[15] Keen describes DSS as a system that will:

- Support decision makers in non-routine problem solving;
- Permit ease of access and flexibility of use; and
- Provide a personal tool for the decision maker.

DSS will not necessarily mean state-of-the-art technology. The technology is surveyed only after a decision maker's information and analysis needs are defined.

Keen describes three criteria to be used in developing a DSS. A review of these criteria will also provide a basis for examining how DSS relate to planning needs and computer technology.

Accessibility. A DSS must be accessible to be used. Since administrative jobs

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[15] Keen

require good time management, a successful tool has to fit into the time slots available for a decision maker rather than the other way around.

Flexibility. A DSS must be flexible. The dynamic state of university planning has already been described. Because of these changing challenges and the unstructured nature of management decisions, the information needs of an administrator are constantly varying. An inflexible system cannot be effective in such a situation.

Ease of Use. A DSS must be easy to use for two reasons. First, ease of use is complementary to accessibility. The less training and documentation required for use, the greater the effectual accessibility of the system. Second, a DSS should reflect the personal inclinations of the decision maker using it. An administrator ought to be able to get a data listing from a command like "REPORT" or "LIST" rather than being required to use a command like "PRINT" from a specialized program.

Of course, the DSS concept would not be feasible if technology were not available to make such systems possible. Computer trends have resulted in dramatic increases in the amount of computing available, the packages available, and the amount of user documents available. This technology now makes DSS possible.

An Information Strategy

Previous sections have described the dynamic planning situation for colleges and universities, the diverse planning systems required, and the opportunities offered by computer technology. A strategic analysis of information systems points to the promise of DSS as a strategy for developing an appropriate information system for a university.

There are still several difficult questions that remain to be answered about DSS implementation:

- What is the appropriate level of detail for a planning database?
- How much emphasis should be placed on internal planning data versus competitive strategic planning information?
- Can administrators be convinced to allocate funds for data collection and computing technology for a DSS?

The next sections of the paper will review formative DSS experiences at Carnegie-Mellon and other universities. Likely impacts on institutional research of the wide spread use of DSS will also be explored.

CMU Planning and Computing Environments

A review of Carnegie-Mellon's planning and computing situations offers a background for its DSS efforts. CMU's planning environment can be characterized by emphasis on strategic planning and planning support information. The University completed a long range planning cycle in 1981 that stressed strategic planning. This is the third planning cycle in Richard Cyert's ten years as CMU's president. CMU was one of the pioneer users of EFPM when EDUCOM first introduced the system. Carnegie-Mellon then became a user of EMPIRE, a business forecasting computer package, and now offers this software through EDUNET. CMU recently became a user of IFPS, another forecasting package, developed by Execucom.

CMU's computing environment can be characterized by emphasis on time-sharing with wide-spread access, strong document formatting capabilities, and increasing emphasis on graphics. Computing at Carnegie-Mellon has become a significant resource for education, research, and administration. Its significance promises to become even greater in the future.

One of the university's current efforts has been to establish an executive information system for CMU's top administrators. Funds have been allocated to provide terminals for each executive and a manual has been written to guide administrators in their use of the operating system, screen editor, document formatting system, etc. Anticipated uses of the system include electronic mail, text processing, analysis (through the planning database), budget planning, and calendar arrangement. Carnegie-Mellon is currently planning a distributed computer system to be implemented during the next eight years. The proposed system would feature personal computers, or clusters of personal computers, connected by a network.

Carnegie-Mellon's organizational structure reflects a recognition of the interdependence of planning and computing. CMU's Vice Provost for Planning and Computing is responsible for academic computing, administrative data processing, and planning. Similar umbrellas of "Planning and Systems" or "Information Services" are seen more frequently at universities.

Carnegie-Mellon Experiences

Prototype

A variety of interests led to the creation of a planning database at Carnegie-Mellon. University executives had expressed interest in an on-line management information system. The Planning Department had an interest in a flexible system to provide reports and analyses. While the Planning Department had a wealth of information about university departments, the data frequently needed to be reformatted for specific project needs. Executives were frustrated by the time delays often required for data manipulation and typing. While these forces urged the creation of an on-line planning database, there was hesitation at the costs required to create a custom information system for CMU. The costs of such a system were conservatively estimated to be $50,000 to $100,000. Even such a system would not have been a panacea. Expectations were that even a thoroughly and thoughtfully designed system would have to be modified in light of user experiences and changing information demands.

A prototype database was the solution to these needs. The problem still existed, however, to find an inexpensive way to create such a prototype. Fortunately, the increases in programming costs had created a climate which rewarded the creation of general data manipulation packages. Several of these packages were flexible enough to be considered for the database project.

The following capabilities were required for the system:

- file input/output;
- data "browsing";
- report writing;
- statistical analysis;
- plotting; and
- programming features.

Important programming features included the amount of instruction coding required to set up the database, flexibility for modifications, and ease of use.

Several general categories of existing computer packages were examined. The main categories were data management, modeling, and analytic. Each of the specific systems reviewed were evaluated against the required capabilities. During the evaluation it became clear that the modeling packages offered the greatest flexibility. While not superior in

each capability desired, they provided the broadest coverage of those features. An assumption in the database design was a requirement that a single system be used as a basis for the planning information system.

Design and Structure

A basic question in developing the database was what data to use. The information selected were those items which had been used frequently for planning activities and which were readily available from CMU's *Statistical Handbook* and *Financial Statements*. (These data were collected from printed sources although much of the information came from summaries of computer-based files). The data included units taught, net assigned space, E&G budget and expenditures, research and restricted expenditures, enrollments, and faculty.

The database was structured at the departmental level with aggregation to the college and university level. The data were structured along three dimensions: department, variable (e.g. undergraduate FTE enrollment), and time (e.g. fiscal year). Unfortunately, the modeling package selected for the prototype, EMPIRE, is organized along two dimensions. This is true of most modeling systems. This design factor meant that two of the database dimensions had to be created along one dimension of the model. This structure increased the complexity and reduced the flexibility of the database.

Because of the structure of the model, three formats were created for ease of use. The basic model allots 10 columns for each department: five for historical data and five for forecasting. A compact model uses five columns of historical data only and is used for most reporting and data retrieval. A fiscal year model includes only one year of data for each department and is used for reports on a single year's activity or for cross-sectional data analysis.

Since the database was developed in the EMPIRE language, a user's guide was created to show people, without previous experience, how to use the database. Several report files were created as part of the database to permit simple retrieval. For example, one report lists all variables for a specified department, another prints all departments for a specified variable. These "canned" reports permit a user to get a listing of the information desired without having to specify column width, number of decimals, or other detailed report format options.

The database is useful for statistical analysis. One common analysis is creating ratios and reviewing patterns among departments. Units taught per full time faculty member is one example. The EMPIRE package also permits multiple regression analysis. Regressions can often be an interesting tool to use in studying the relationship of resource use (e.g.

E&G budgets) to departmental activity (e.g. units taught and sponsored research).

Plots were another interesting application of the database. One feature of the database was the creation of variables indexed to the first year of the historical information. For example, the number of full-time faculty in a department in fiscal 1976 through 1982 could be divided by the number in fiscal 1975 to create the indexed variable. A plot of the indexed variable would therefore show trends very easily. Since EMPIRE permits multiple plots on one graph, several indexed variables could be plotted at once for a department. This kind of plot could show the faculty, student, units taught, E&G, and research activity trends for a specific department or college. Although too much information on one plot can be confusing, this technique is a powerful way of showing major changes (positive and negative) in a department or college.

CMU Experiences

Keen's criteria of accessibility, flexibility, and the quality of the user-system interface provide a means of evaluating CMU's experiences.[16] CMU's prototype database has improved the accessibility of the information, although improvements could still be made. The advantage of the computer-based system is the accessibility of the data, far better than when it was on printed sources. Access could be improved, however, since the prototype requires the user to learn a few commands in the base language (EMPIRE, in this case). An ideal system would have commands geared to the verbs used by executives as they think about how they want information.

Flexibility is the outstanding attribute of the database. A user has the choice of retrieving information by variable, department, or time with any combination of these choices for pieces, a section, or the entire range of data. The purpose of the planning database was to offer executives the power of quickly and easily choosing, and changing, the trends, or comparisons, or analysis desired when looking at any data to explore any management concerns.

The prototype experience has been useful in several ways. The database was used at CMU last summer when trend graphs were being prepared for a planning conference. The graphs showed faculty, units taught, and financial trends by college. There are several aspects of the database which could be improved. The basic two-dimensional structure of modeling systems is one concern. This led the Planning Department to reinvestigate available systems to check the state-of-the-art. This search turned up IFPS, a similar package to EMPIRE. IFPS has a couple of advantages which could make it a better base

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[16] Keen

for a planning system. IFPS permits permanent changes to the model while the model is running. (In EMPIRE, permanent data changes can be made, but permanent model changes require leaving EMPIRE and making changes using the computer's editing system). Also, IFPS allows the creation of subsidiary models which can be tapped while the main model is running. (In EMPIRE, only one model can be loaded at a time. Therefore, in the planning database a user would have to stop running the basic model and start running a fiscal year model if he or she wanted to change from data forecasting to data analysis of a specific year's information.)

Another problem encountered was the availability of help messages on EMPIRE. While EMPIRE has help messages, they are not universal and are too technical in many cases to help novice users. Also, EMPIRE has no schematic which shows the "tree" structure of its commands. These kind of "user friendly" aids would be very important for a planning database to be used routinely by executives. (In fairness to EMPIRE, it should be recognized that EMPIRE was designed as a forecasting and analysis package to be used by corporate planning staffs. It was selected for the planning database with the realization that it had certain limitations for such a use.)

A pleasant surprise during the course of the project was the creation of GIGI (a Digital color graphics terminal) compatibility with EMPIRE. Although EMPIRE plots are less sophisticated than those produced by a graphics package like TELLAGRAF, it is useful to be able to produce color graphs. Color is especially helpful for differentiating lines on graphs.

The on-line planning database has not been Carnegie-Mellon's only distributed information project. The cashier's office has installed a terminal that permits on-line access to student financial records. A printer provides a copy for students to examine their statements. This system has provided better service to students. The admissions office has an on-line system that permits a user to review the status of applications, admissions, and matriculation decisions. The data can be viewed at the departmental, college, or university level and is also presented in SAT groupings. Deans are among the users who can access this information. This system also provides high, medium, and low yield projections based on past admissions trends. Another recent application made student schedule and grade point average data available to departments and colleges on an on-line basis through their remote terminals. The next planned project will make faculty schedules similarly available.

Two aspects of the CMU experience should be noted. Carnegie-Mellon may be in a relatively limited group of universities that have knowledgeable computer users among executives. One of the university's Provosts and the Vice President for Finance have had

extensive computer experience. They would obviously be more receptive to the concept of a planning database and be able to make use of such a system more readily than less computer-knowledgeable executives. The other aspect of the experience was a more universal one. Although the prototype was developed by August, 1981, other activities have kept the final implementation from taking place. Two kinds of activities have taken priority. One kind were on-going commitments. Until terminals are extensively available on campus, the Planning Department must produce the hard copy fact book before it can refine the computer-based planning information system. Another kind of task were new projects demanded by executives. The executives were essentially saying that they valued new information, where they formerly had little, as more valuable than refining existing information. (Of course, this is also a question of the staff role of Planning for senior executives versus the role as an information resource for the campus).

Other University Experiences

Decision Support System activities are appearing at a variety of universities. The Stanford experience with modeling for financial planning has been previously cited. Chaffee has described the main uses of modeling at Stanford.[17] These information uses included: providing a structure for initial values, bringing together diverse people to give them a university-wide perspective, identifying information gaps, providing concepts like financial equilibrium, and acting as a symbol of rationality. Clearly other techniques can also achieve these same information goals. But planning issues are usually sufficiently complex that a computer model (in the case of financial planning) makes the task much easier.

Loyola University (Chicago) has developed and tested a system featuring the use of a special systems analyst and user friendly packages. The concept was to offer administrators a timely information system that recognized decision support needs. The analyst acted as an interface between the decision maker and the database and software. The packages used were ones like SPSS, SAS, and Waterloo SCRIPT. Set up time was limited to three days. A control and review process was created after initial experiences to channel bigger projects through traditional administrative systems projects. While not a classic DSS (since the decision maker worked through an analyst), this project was a successful demonstration recognizing the distinction in scale, timeliness, and structure of decision support requirements in contrast to traditional management information operation support needs.[18]

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[17] Chaffee in CAUSE 1981 Proceedings

[18] Doty and Krumery

Boston College has used a specialized decision support system. An admissions database has been created which is accessed by SCSS (conversational SPSS). This system permits researchers to access admissions data to review yields for any desired group or to perform regression analysis on the data to reveal significant yield factors. Again, like the Loyola experience, this system is not used directly by decision makers, but it is a decision support system for admissions researchers and is a step away from traditional management information data processing toward DSS.[19]

There are other examples of colleges experimenting with DSS. These examples cited show how two institutions have taken a first step toward creating a DSS.

Likely Impacts

Several sets of likely impacts can be attributed to the wide use of Decision Support Systems in higher education. The impacts are expected in the following areas:

- Planning Process;
- IR Role;
- IR Career Paths;
- Institutional Resources.

Planning Process

The planning process will be affected in two ways: technically and organizationally. The technical changes will be more explicit assumptions and more consideration of options.

Updegrove has cited increased focus on assumptions as one of the benefits listed by modelers in a survey of EFPM users.[20] One of the advantages of a computer-based system is the structure required to use data or models. While that structuring may require additional effort to state initially, it has the advantage of explicitly specifying the important facts or relationships being considered. This explicitness makes it possible to check the consistency of assumptions or to consider alternate assumptions. Both of these are valuable activities in a planning process where the goal is often reaching understanding or consensus about a proposed course of action.

Just as a computer-based system focuses more attention on assumptions, it also

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[19] From telephone conversation with Robert Lay, Boston College, May, 1982

[20] Updegrove

permits consideration of more policy alternatives. Updegrove has cited this as another important benefit stated by EFPM modelers and users.[21] Since computers permit rapid manipulation of data, they are ideal tools for allowing the running of more options in a given period of time. A decision maker or analyst has the choice of increasing the breadth or depth of a planning study. Having the data computer-based allows this investigation either for retrospective studies (e.g. a regressions analysis comparing departmental budgets or space allocation to levels of activity) or for future-based studies (e.g. enrollment forecasts, given changes in college or class level retention rates). Planners and policy makers generally feel that increased analysis, or increased options, is desirable. Certainly this increase places a greater responsibility for planners to summarize key issues or to develop meta or macro structures for planning or analysis.

The organizational change could be a democratization of the planning process. Wellesley, through EFPM, has already had some experience in this area. When the central administration started using EFPM the Advisory Committee on Budgetary Affairs Chairman was given his own EFPM account. The chairman, a faculty member in the mathematics department, used the system to test alternate assumptions and to develop endowment and financial aid submodels. The Budget Director and the Advisory Committee Chairman played a collegial role in using the models for policy development. This experience at Wellesley shows the opportunity offered by decision support systems to share information and policy development.[22]

IR Role

Institutional researchers have the current role of advisers to executives on decisions. If Decision Support Systems become widely used, the institutional research role emphasis will change to that of adviser to executives on the decision process. This role may decrease contact with provosts and the president while increasing contact with department heads. It will be interesting to see what changes this might have on planning and institutional research.

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[21] Updegrove

[22] Telephone conversations between the author and Elizabeth Bark and Fred Shultz of Wellesley College in May, 1982

IR Training, Experience, & Career Paths

Institutional research careers are likely to change with computer literacy becoming a "core" requirement for institutional research. This change may then cause people to come to institutional research from other backgrounds and to go into other fields from institutional research.

Undoubtably some institutional researchers will view expanded computing as an opportunity while others may view such changes as a threat. Even computer professionals have mixed emotions about the coming of micro and mini computers.[23] There are certainly increased opportunities for institutional research to play a broader role at universities. Distributed data processing creates a need for greater coordination.[24] Some of the areas of concern among department heads and institutional researchers are: common data element definitions, documentation, software development, standards, and communications. With these opportunities for institutional researchers to contribute from their unique organizational perspective, comes a need for institutional researchers to increase their computer literacy. This becomes one more responsibility for people who are already required to keep on top of several fields, in addition to societal trends, in addition to activities at their own institutions.

Analysis of information becomes important, especially as more "information" becomes available to more people. Again, institutional researchers are suited by their training both to provide frameworks for organizing information and to use analytic methods to reduce or highlight information.

The issue of appropriate computer training for institutional research becomes more difficult, however, when thinking about the variety of computing environments which exist, or which might exist, in colleges and universities. As with other new training "requirements" the issue could be addressed of what priority gaining computer literacy should have.

Thinking about institutional research career paths is more speculative. One possibility is the opening up of more paths for entry to or movement from institutional research careers. This may not be so far fetched when one sees a small, but significant numbers of former physicists who are now institutional research practitioners. On the one hand, institutional research could be an occupation for computer programmers who are looking for a broadening experience. On the other hand, the kinds of things done in institutional

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[23] Crane

[24] Staman

research may become more common between universities, other non-profits, and even businesses. These possibilities are interesting but job requirements may lag new job content, as managers try to maintain traditional career paths to reduce uncertainty about the performance of new professional staff members.

Institutional Resources

Decision Support Systems will require additional funding. The variety of available systems allows institutions to choose the scale of system that is appropriate. The argument has been advanced that both administrative and secretarial jobs have been under capitalized. Decision Support Systems have the potential for increasing the effectiveness and productivity of administrators. It would be interesting to have research on this issue when systems become widely used.

Other Issues

Clearly there are dangers with planning databases. One danger is that too much time will be spent on the wrong issues. (Of course, this is a planning danger regardless of the technology used). Another danger is focusing on quantitative data to the exclusion of qualitative data. Computing support will be as useful for both types of data, although it has been used more historically for quantitative issues. (Again, this is a planning issue regardless of the technology.)

These dangers have a flip side. The opportunity is the need for institutional researchers to engage in meta-analysis or greater use of heuristics. The same budget planning model that has 100 variables can also be used to develop a useful heuristic: with the structure of the budget at a specific university, tuition has to go up at 2% faster than faculty salaries increase, if the budget is to be balanced. Another useful heuristic is that of critical success factors. This concept has been used to develop management information systems for businesses.[25] Critical success factors for a private research university would include: admissions yield, relative faculty salaries, and faculty research productivity.

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[25] Rockart

Summary

Colleges and universities will continue to experience a dynamic planning environment. One likely impact is a complex planning process. Computing technology offers the capability of providing significant planning support. Decision Support Systems is a concept that can take appropriate advantage of computing technology for planning support. Computerized planning information offers the potential for democratizing or sharing the planning process. The widespread use of decision support systems could have substantial impacts on institutional research. Institutional research roles could involve more effort in developing decision support tools and less effort in actual research and analysis. Institutional researchers could spend more time with deans and department heads and less time with the president and provosts as planning information and support becomes more distributed. If Decision Support Systems become widely used in institutional research, computer specialists could become institutional researchers and institutional researchers could be more likely to move into positions in other non-profit organizations or industry. DSS certainly offers a promising strategy for providing planning support in colleges and universities.

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